GEORGIA INSTITUTE OF TECHNOLOGY — OFFICE OF CONTRACT ADMINISTRATION

PROJECT ADMINISTRATION DATA SHEET

[x] ORIGINAL [ ] REVISION NO. _____

Project No. E-26-630 (Co-project E-26-624/Carter) DATE 5/11/82

Project Director: M.W. Carter School/~~Lab~~ Nuclear Engr.

Sponsor: Oak Ridge Associated Universities

Type Agreement: P.O. No. C-26040 and Rev. A (D.O.E. Prime DE-AC05-76OR00033)

Award Period: From 3/1/82 To 9/30/82/84 (Performance) _____ (Reports)

Sponsor Amount: $120,325.70 (plus $14,674.30 in coproject E-26-624) Contracted through:

Cost Sharing: None GTRI/~~GIT~~

Title: Energy, Health and Environmental Research Program

ADMINISTRATIVE DATA OCA Contact William F. Brown x4820

1) Sponsor Technical Contact:

2) Sponsor Admin/Contractual Matters:

Mr. C.W. Flegal, Purchasing Agent
P.O. Box 117
Oak Ridge TN 37830
(615) 576-3049

Defense Priority Rating: none Security Classification: none

RESTRICTIONS

See Attached _____ Supplemental Information Sheet for Additional Requirements.

Travel: Foreign travel must have prior approval – Contact OCA in each case. Domestic travel requires sponsor approval where total will exceed greater of $500 or 125% of approved proposal budget category.

Equipment: Title vests with none proposed or anticipated.

COMMENTS:

COPIES TO:

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Computer Input
Project File
Other _____

FORM OCA 4:781

GEORGIA INSTITUTE OF TECHNOLOGY OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION/CLOSEOUT SHEET

Date 8/27/85

Project No. E-25-658 (Formerly E-26-630) School/Lab NE

Includes Subproject No.(s)

Project Director(s) Dr. M. W. Carter GTRC / ~~GIT~~

Sponsor Oak Ridge Associated Universities

Title Energy, Health and Environmental Research Program

Effective Completion Date: 5/4/84* (Performance) (Reports)

Grant/Contract Closeout Actions Remaining:

- [X] None
- [ ] Final Invoice or Final Fiscal Report
- [ ] Closing Documents
- [ ] Final Report of Inventions
- [ ] Govt. Property Inventory & Related Certificate
- [ ] Classified Material Certificate
- [ ] Other

*A Stop Work Order was Issued Effective 5/4/84. Project was originally to have run through 9/30/84. Close down costs were incurred after 5/4/84 and have now been paid by Sponsor.

Continues Project No. Continued by Project No. Co-Project E-26-624

(Terminated eff. 4/30/8

COPIES TO:

Project Director
Research Administrative Network
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Accounting
Procurement/GTRI Supply Services
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Jones

FORM OCA 69.285

LYNN MESSENGER
RE E-26-630

Georgia Institute of Technology
A UNIT OF THE UNIVERSITY SYSTEM OF GEORGIA
SCHOOL OF NUCLEAR ENGINEERING AND HEALTH PHYSICS
ATLANTA, GEORGIA 30332
(404) 894-3720

May 31, 1982

Dr. A. Alan Moghissi
Senior Science Advisor
U. S. Environmental Protection Agency
Energy and Air Division
401 M Street, SW, Mail Drop RD 682
Washington, D.C. 20460

Dear Dr. Moghissi:

Enclosed is a brief progress report on the status of the peer review process for the U. S. Environmental Protection Agency's Integrated Risk Analysis for Synfuels Program. The Peer Review Group has been established and has reviewed the program. In addition, two Peer Review Panels, chaired by members of the Peer Review Group, have been set up and have conducted pertinent program reviews. These Panels are titled "Human Health Effects of Synfuels Production" and "Food Chain Transport of Synfuels."

The composition of these groups, an outline of their activities to date, and several current considerations are presented in this progress report.

Sincerely yours,

Melvin W. Carter

Melvin W. Carter
Executive Director, PRG

MWC/lm
Enclosures

Peer Review Group

The Peer Review Group has been established and has met for two days to review the U. S. Environmental Protection Agency's Integrated Risk Analysis for Synfuels Program. This activity is summarized in the attached report, dated January 1982, which was sent to the Project Officer et al. An inherent part of this report is the identification of the members of this eminent group which has been organized to provide scientific peer review for the Agency's relevant research programs. The Peer Review Group is chaired by Professor Norman C. Rasmussen of the Massachusetts Institute of Technology.

Human Health Effects of Synfuels Production--A Peer Review Panel

This Panel has the following membership:

Arthur C. Upton, M.D.--Chairman
Chairman and Professor
Department of Environmental Medicine
New York University Medical Center
550 First Avenue
New York, New York 10016
(212) 340-5280 (5913)

Vaun A. Newill, M.D.
Associate Medical Director
Exxon Corporation
1251 Avenue of the Americas
New York, New York 10020
(212) 398-2786

Steven Blum, M.D.
Cornell University Medical College
Department of Public Health
411 East 69th Street
New York, New York 10021
(212) 794-6580

The Panel met on May 6, 1982, at the Medical Department, Brookhaven National Laboratory, to review the Human Health Effects of Synfuels Production. A report of this meeting is under preparation at this time.

Food Chain Transport of Synfuels--A Peer Review Panel

This panel has the following composition:

Dr. Burton E. Vaughan--Chairman
Manager, Ecological Sciences Department
Battelle PNL
P. O. Box 999
Richland, Washington 99352
(509) 376-3602

Dr. George W. Lucier, Head
Receptor Pharmacology Section
Laboratory of Pharmacology
National Institute of Environmental Health Sciences
P. O. Box 12233
Research Triangle Park, North Carolina 27709
(919) 541-3802

Dr. Allan R. Isensee
Plant Physiologist
Pesticide Degradation Laboratory
ARS, Department of Agriculture
Building 050
Beltsville Agricultural Research Center
Beltsville, Maryland 20705
(202) 344-3076

This Panel met at the Comparative Animal Research Laboratory in Oak Ridge, Tennessee, on May 18, 1982, to review the Food Chain Transport of Synfuels. A report of this meeting is currently being developed.

Other Activities

Consideration is being given to the addition of several individuals to the Peer Review Group. They represent scientific disciplines not presently covered by current members.

Plans are also under development for several topical workshops in areas of special interest in the project and its various participants.

Georgia Institute of Technology
A UNIT OF THE UNIVERSITY SYSTEM OF GEORGIA
SCHOOL OF NUCLEAR ENGINEERING AND HEALTH PHYSICS
ATLANTA, GEORGIA 30332
(404) 894-3720

March 10, 1983

Dr. A. Alan Moghissi
Senior Science Advisor
U.S. Environmental Protection Agency
Energy and Air Division
401 M Street, SW, Mail Drop RD 682
Washington, D.C. 20460

Dear Dr. Moghissi:

Enclosed is a progress report on certain activities pertaining to the EPA's Integrated Health and Environmental Risk Analysis Program for Synfuels. More specifically, it summarizes a recent "Water Modeling for Risk Analysis" Workshop for Synfuels, presents information on a Food Chain Modeling Workshop which is upcoming in March, and presents the general schedule for a peer review of the research program scheduled for March 29th and 30th. In addition, mention is made of a fossil-based synfuels symposium for which preliminary planning has begun.

Certain supporting information is also enclosed with this progress report for record purposes.

Please let me know if you should have any questions or comments regarding this material.

Sincerely yours,

Melvin W. Carter

Melvin W. Carter
Neely Professor

MWC/bb

Enclosures

cc: Mr. William F. Countiss
Office of Contract Administration ✓

WATER MODELING FOR RISK ANALYSIS WORKSHOP FOR SYNFUELS

This Workshop was conducted in facilities of the Georgia Institute of Technology in Atlanta, Georgia on January 18-20, 1983. The Moderator for the Workshop was Dr. Walter M. Sanders, III of the EPA Environmental Research Laboratory in Athens, Georgia.

Twenty individuals participated in the Workshop and basically represented backgrounds in surface and ground water modeling as well as risk analysis. A list of participants and their normal affiliations is attached.

The agenda for the Workshop is attached and details information or subjects addressed by the participants. In addition, a copy of the letter of invitation is attached for record purposes.

A Workshop report is presently being prepared for pertinent review. It should be available for this purpose in about two to three months.

FOOD CHAIN MODELING FOR RISK ANALYSIS WORKSHOP FOR SYNFUELS

This Workshop is scheduled to be conducted in Washington, D.C., March 22-24, 1983. It will be moderated by Dr. Larry W. Barnthouse, Leader, Environmental Risk Analysis Group, Environmental Sciences Division, Oak Ridge National Laboratory.

Approximately twenty-five individuals with background in terrestrial and aquatic food chains and in risk analysis are scheduled to participate.

PROGRAM PEER REVIEW

This activity has been scheduled to be held in Alexandria, VA on March 29-30, 1983. Dr. Norman R. Glass, Corvallis Environmental Research Laboratory, has organized the meeting which is being logistically supported.

The invitations have been extended and the agenda has been distributed to those scheduled to participate.

FOSSIL BASED SYNFUELS SYMPOSIUM

Plans are continuing to hold a large, comprehensive Symposium in Atlanta, Georgia during November 14-18, 1983, at the Atlanta Sheraton Hotel.

Sponsors thus far include:

Electric Power Research Institute

Society for Risk Analysis

Industrial Environmental Research Laboratory, EPA, RTP, NC

Integrated Health and Environmental Risk Analysis Program, EPA, Washington, D.C.

Subjects expected to be addressed are: Needs, Resources, Technologies, Economics, Environmental Effects, Health Effects, Risk Analysis, Standards, and Regulations.

PARTICIPANTS AT THE

WATER MODELING FOR RISK ANALYSIS WORKSHOP

FOR SYNFUELS

GEORGIA INSTITUTE OF TECHNOLOGY

ATLANTA, GA 30332

January 18-20, 1983

Lawrence W. Barnthouse
Environmental Sciences Division
Oak Ridge National Laboratory
P.O. Box X
Oak Ridge, TN 37830

Steven M. Bartell
Environmental Sciences Division
Oak Ridge National Laboratory
P.O. Box X
Oak Ridge, TN 37830

David C. Bomberger
SRI International
Chemical Engineering Laboratory
333 Ravenswood Ave.
Menlo Park, CA 94002

Stuart M. Brown
Battelle, Pacific Northwest Laboratories
P.O. Box 999
Richland, WA 99352

Melvin W. Carter
Neely Professor
School of Nuclear Engineering
and Health Physics
Georgia Institute of Technology
Atlanta, GA 30332

Dominic M. DiToro
Environmental Engineering & Science
Manhattan College
Bronx, NY 10471

Anthony Donigian, Jr.
Anderson-Nichols
2666 East Bayshore Rd.
Palo Alto, CA 94303

Jim Falco
Office of Health & Env. Assessment
ORD
401 M St., S.W.
Washington, D.C. 20460

Kenneth J. Hood
Office Research and Development RD682
Environmental Protection Agency
Washington, D.C. 20460

Joseph F. Keely, Hydrologist
Ground Water Research Branch
R.S. Kerr Environmental Research
Laboratory
P.O. Box 1198
Ada, OK 74820

Ray R. Lassiter
Athens Env. Research Lab
Athens, GA 30613

A. Alan Moghissi
EPA/ORD/OEPER
Energy and Air Division
Washington, D.C. 20460

Sam Morris
Biomedical and Environmental
Assessment Division
Brookhaven National Lab
Upton, NY 11973

Lee A. Mulkey
Technology Development and
Application Branch
EPA-ORD
College Sta. Rd.
Athens, GA 30601

Malcolm R. (Mack) Patterson
Oak Ridge National Laboratory
Bldg. 4500N, Rm. B226
Oak Ridge, TN 37830

Donald B. Porcella
Tetra Tech, Inc., Suite 300
3746 Mt. Diablo Blvd.
Lafayette, CA 94549

Thomas A. Prickett, President
Thomas A. Prickett & Associates
Number 8 Montclair Road
Urbana, Illinois 61801

Donald J. Rodier
Environmental Effects Branch
Health & Env. Review Division
401 M St., S.W.
Washington, D.C. 20460

Walter M. Sanders, III
EPA-ORD
Env. Research Laboratory
College Station Road
Athens, GA 30613

Curtis C. Travis, Leader
Exposure Analyze Group
Health & Safety Research
Division
Oak Ridge National Lab
Oak Ridge, TN 37830

Proposed Agenda

Water Modeling for Risk Analysis

Tuesday - January 18, 1983

8:30 am	Registration
9:00 am	Welcome, Dr. Carter and Dr. Moghissi
9:05 am	Introduction, Dr. Sanders
	Description of Needs for Water Models for Integrated Health and Environmental Risk Analysis Program for Synfuels.
9:15 am	Dr. Frank Robber, DOE
9:30 am	Dr. Sam Morris, Brookhaven National Laboratory
9:45 am	Dr. Steve Bartel, Oak Ridge National Laboratory
10:00 am	Coffee Break
10:15 am	Dr. Larry Barnthouse, Oak Ridge National Laboratory
10:30 am	Dr. Curtis Travis, Oak Ridge National Laboratory
10:45 am	Dr. Mack Patterson, Oak Ridge National Laboratory
11:00 am	Discussion
	Description of needs by others involved in Risk Analysis.
11:15 am	Dr. Jim Falco, EPA, OHEA
11:30 am	Mr. Don Rodier, EPA, OTS
11:45 am	Lunch
1:15 pm	Mr. Tim Berry, EPA
1:30 pm	Mr. Bill Williams, EPA
1:45 pm	Dr. Ken Hood, EPA, ORD
2:00 pm	Discussion
2:45 pm	Break
3:00 pm	Review of Exposure Assessment Workshop and Field Applicability Workshop - Mr. Lee Mulkey
4:00 pm	Discussion of Runoff Models
4:30 pm	Adjourn

Wednesday - January 19, 1983

8:30 am	Continue Discussion of Runoff Models
10:00 am	Break
10:30 am	Discussion of Water Models
11:45 am	Lunch
1:15 pm	Continued Discussion of Water Models
2:45 pm	Break
3:15 pm	Discussion of Ground Water Models
4:30 pm	Ajourn

Thursday - January 20, 1983

8:30 am	Continued Discussion of Ground Water and Estuarine Models
10:00 am	Break
10:30 am	Discussion
11:30 am	Concluding Remarks
11:45 am	Ajourn

Georgia Institute of Technology
A UNIT OF THE UNIVERSITY SYSTEM OF GEORGIA
SCHOOL OF NUCLEAR ENGINEERING AND HEALTH PHYSICS
ATLANTA, GEORGIA 30332
(404) 894-3720

December 20, 1982

Letters of invitation varied slightly depending on whether or not the individual is a water modeler or a risk analyst

Curtis Travis
Oak Ridge National Laboratory
Health and Safety Research Division
Bldg. 4500 South
P.O. Box X
Oak Ridge, TN 37830

Dear Curtis:

The EPA Environmental Research Laboratory, Athens, Georgia has been requested to organize a workshop on "Water Modeling for Risk Analysis" for EPA's Integrated Health and Environmental Risk Analysis Program for Synfuels (IHERAP). IHERAP is closely coordinated with the Health and Environmental Effects Program (HEEP) of the Department of Energy, and scientists and engineers from both DOE and EPA, their contractors, and the experts from the general scientific community will be invited to participate in the workshop.

The objectives of the workshop are:

1. Provide an opportunity for scientists involved in risk analysis to communicate their needs in terms of:

   . operational definitions
   . application of risk procedures
   . input requirements
   . characteristics of inputs
     - time (immediate-lifetime)
     - space (near field-far field)
   . criteria for acceptability
   . limitations - $, time, hardware, personnel

2. Provide an opportunity for water modelers to identify and communicate the capabilities and limitations of water quality and toxic chemical exposure models that are available for synfuels risk analysis.

3. Provide basic information for a workbook summarizing the various models identified by the workshop participants for use by IHERAP, HEEP, and others in conducting Risk Analysis for chemicals related to synfuels programs.

With this background, I would like to invite you to participate in the workshop and to draw on your knowledge and expertise in identifying models and their strengths and weaknesses relative to the needs related by the synfuels risk analysts present.

The workshop will be held on the Georgia Tech campus, Space Science and Technology Building, Atlanta, Georgia on January 18-20, 1983, beginning at 8:30 a.m. on January 18. It will be concluded no later than noon on the 20th. The enclosed map locates the Space Science and Technology Building (#10) in relationship to other campus sites.

There are several convenient hotels/motels to the Tech campus. Two of these are:

Howard Johnson's
Midtown Atlanta
100 Tenth St., NW
Atlanta, GA 30309
(404) 892-6800

Sheraton-Atlanta Hotel
590 West Peachtree St., NW
Atlanta, GA 30308
(404) 881-6000

Each will give a room discount if you identify yourself as a participant in this Workshop to be conducted at Georgia Tech.

We look forward to having you here in January and hope you have pleasant and enjoyable holidays. Should you have any questions in the interim, please contact either Dr. Walter Sanders or me:

Dr. Sanders	Athens, GA	(404) 546-3171
Dr. Carter	Atlanta, GA	(404) 894-3745

Best personal regards.

Sincerely yours,

Melvin W. Carter
Neely Professor

MWC/bb

Enclosures

E-26-630

Georgia Institute of Technology

A UNIT OF THE UNIVERSITY SYSTEM OF GEORGIA

SCHOOL OF NUCLEAR ENGINEERING AND HEALTH PHYSICS

ATLANTA, GEORGIA 30332

(404) 894-3720

November 11, 1983

E-26-630/Carter

Dr. A. Alan Moghissi
Senior Science Advisor
U.S. Environmental Protection Agency
Energy and Air Division
401 M. Street, S.W., Mail Drop RD 682
Washington, D.C. 20460

Dear Dr. Moghissi:

April through Sept. 83

Enclosed is a progress report on certain activities pertaining to the EPA's Integrated Health and Environmental Risk Analysis Program for Synfuels. Certain supporting information is also attached with this report for record purposes.

If you should have any questions or comments regarding this material, please let me know.

Sincerely,

Melvin W. Carter

Melvin W. Carter
Neely Professor

MWC/bc
Enclosures
cc: Mr. William F. Countiss, Oakridge
Contract Administration, Georgia Tech
Ms. Velda Williams, Georgia Tech

PROGRESS REPORT

APRIL - SEPTEMBER, 1983

RESEARCH PROGRAM PEER REVIEW

The special Peer Review Group convened March 29-30, 1983 in Alexandria, VA and the report for its review was prepared in April. Assistance was provided to Dr. Stanley M. Greenfield with the report which was distributed to pertinent individuals in late April. A copy of the report is enclosed for reference purposes.

WATER MODELING FOR RISK ANALYSIS WORKSHOP FOR SYNFUELS

A draft report for the Workshop was prepared by Anderson-Nichols and submitted to about six critical reviewers. These reviewers were selected from among the Workshop participants. Comments were received from the various reviewers, consolidated and furnished to Anderson-Nichols for consideration in revision of the report.

It is anticipated that the final report should be completed and available for distribution in the Fall.

FOOD CHAIN MODELING FOR RISK ANALYSIS WORKSHOP FOR SYNFUELS

This Workshop was conducted in Washington, D.C. March 22-24, 1983 and thus a report on it was initiated during this period. The responsibility for the report preparation has been assigned to the Environmental Risk Analysis Group of the ORNL Environmental Science Division.

A draft report should be available for critical review in late Fall.

FOSSIL BASED SYNFUELS SYMPOSIUM

In order to broaden the base of support for the Symposium and to avoid certain problems in scheduling, the dates for the Symposium were changed to June 11-15, 1984. An announcement, copy enclosed, was distributed to a large number of journals, newsletters, etc.

We continue to receive a large number of inquiries both by mail and telephone, regarding the Symposium. Each is answered and cataloged for future reference.

Mailing lists are being compiled for use in contacting individuals with direct information on the Symposium. We have also drafted a brochure which will be of use in publicizing the Symposium.

PEER REVIEW OF FOOD CHAIN RESEARCH

Members of a Food Chain Peer Review Panel were approved by the Office of Research and Development of the Environmental Protection Agency and notified of plans to conduct a peer review on October 27-28, 1983 in Corvallis, OR.

It is planned to meet at the EPA's Environmental Research Laboratory-Corvallis and to review both the plant uptake studies, conducted at the host laboratory, and the animal uptake research being performed by the Oak Ridge Associated Universities, Medical and Health Science Division.

Enclosures

N E W D A T E

THE FOSSIL BASED SYNFUELS SYMPOSIUM
SCHEDULED
JUNE 11-15, 1984

C A L L F O R A B S T R A C T S

The Fossil Based Synfuels Symposium is scheduled to be held in Atlanta, Georgia June 11-15, 1984. Sponsoring bodies include Federal agencies, industrial organizations, academe, and professional groups. It is designed for all those working in or having substantial interest in this important field. Participation by scientists, engineers, and officials from other countries is encouraged and anticipated.

Subject areas to be addressed include:

Requirements	Health Effects
Resources	Risk Analysis
Technologies	Control Techniques
Economics	Standards
Environmental Effects	Regulations

A one-page ABSTRACT for all papers must be submitted to arrive not later than March 12, 1984. ABSTRACTS should contain a statement of purpose, methods used, results obtained, and a statement of principal conclusions.

ABSTRACTS should be type-written and not exceed 250 words. Above the ABSTRACT should be given, in this order, the title of the paper, the name(s) and affiliation(s) of the author(s), with the principal author listed first, and the address and telephone numbers of the principal author.

ABSTRACTS, type-written originals prepared in the proper format and without anything affixed to the abstract, should be submitted by March 12, 1984 to:

Melvin W. Carter, Ph.D.
Neely Professor
School of Nuclear Engineering and
Health Physics
Georgia Institute of Technology
Atlanta, Georgia 30332

Authors will be notified of Scientific Committee action on their ABSTRACTS by April 12, 1984. Accepted papers will be required, in final form, at the time of the SYMPOSIUM. Papers will be peer reviewed and published.

REPORT

OF

THE

PEER REVIEW GROUP FOR THE U.S. ENVIRONMENTAL

PROTECTION AGENCY'S INTEGRATED RISK ANALYSIS

FOR SYNFUEL PROGRAM

APRIL 1983

REPORT OF THE PEER REVIEW GROUP FOR THE U. S. ENVIRONMENTAL PROTECTION AGENCY'S INTEGRATED RISK ANALYSIS FOR SYNFUELS PROGRAM

Purpose

The objective of this report is to summarize the results of a review of the Environmental Protection Agency (EPA) Integrated Risk Analysis for Synfuels Program. The review was conducted on March 28 and 29, 1983 by a Peer Review Group established for this purpose. The members of the Peer Review Group are listed in Attachment 1.

Procedure

Members of the Peer Review Group were provided with several draft documents prior to the review meeting. These documents were prepared by researchers at the Oak Ridge National Laboratory, Environmental Sciences Division, and are identified in Attachment 2. In addition, the Group was provided with additional documents, at the review meeting, prepared by researchers at the Brookhaven National Laboratory. These documents are also identified in Attachment 2.

The agenda for the Peer Review meeting is included as Attachment 3 and the list of participants appears in Attachment 4.

Commentary

Each of the groups involved in this program made an indepth presentation at the Review meeting and was subjected to intensive questioning. Following the formal meeting the Peer Review Group individually provided a detailed written set of comments. This report represents a summary of the reviewer's comments. No attempt was made to report every comment of each review. Rather, an attempt was made to provide a sense of the Review Group's findings. This report should not be construed as necessarily representing a consensus of the Group. Where important minority comments are provided they have been included.

Environmental Assessment

The environmental segment of EPA's Integrated Risk Assessment for Synfuels has been underway at Oak Ridge National Laboratory (ORNL) since 1981. For the purpose of their analysis ORNL selected five environmental end points:

1. Reductions in abundance and production of commercial

or game fish populations.

2. Development of algal populations that detract from water use.
3. Reductions in timber production.
4. Reductions in agricultural production.
5. Reductions in wildlife population.

Five models or methodologies were employed to perform or address the analysis of risk.

1. Quotient method (QA).
2. Analysis of extrapolation error (AEE).
3. Analytic hierarchy method (AHM).
4. Ecosystem uncertainty analysis (EUA).
5. Fault tree analysis (FTA).

For this study ORNL derived aquatic and atmospheric source terms by characterizing the process and waste streams from a hypothetical Lurgi/Fischer-Tropsch indirect coal liquefaction plant. Because of the extremely large number of chemical compounds which can be emitted by a synfuel facility it has been necessary to develop the concept of Risk Analysis Units (RAU's). Under this concept pollutants are grouped in broad, chemically-defined assessment categories that can be used for both environmental and health effects risk analysis. At present, 38 RAU's have been defined. For the hypothetical coal liquefaction plant, ORNL developed aquatic source terms for 17

RAU's, and atmosphere source terms for 25 RAU's. The models and methodologies sited above were then used to independently rank the RAU's with respect to environmental risk and, where possible, to quantify the risk estimates.

Specific Peer Review Group comments are:

1. The ORNL work in environmental risk analysis is pioneering in many ways, and the general approach taken has provided a sensible structure to a previously unstructured area. However, substantial redirection of this work is required if it is to provide a useful understanding of synfuel impacts.
2. In any risk analysis, it is essential to carefully define the terms uncertainty and risk. This is essential although it is not apparent that it was done adequately in the ORNL study. In this regard, ORNL should reconsider its definition of risk and modify its orientation appropriately. ORNL's apparent preoccupation with uncertainty is both premature and ill-advised. The first step should be to develop measures of harm; the second to develop methods for estimating these measures; the third to obtain practical experience in implementing the methods, and finally to attempt to quantify the uncertainty in the estimation. From what was presented, it appears that the last step has proceeded the two previous steps. Additionally, objective approaches at quantifying uncertainty are usually not very successful. Generally there are major sources of uncertainty omitted from the analysis simply because

they are difficult to quantify. For example, the EUA approach, as presented, focuses upon uncertainty analysis. Although, these types of models are attractive as analytical tools, in that they have built-in procedures for propagating uncertainty, one must express considerable reservation concerning our current ability to provide reasonable estimates of uncertainty to use as inputs. However, this does not necessarily mean that current efforts should be directed toward better determining the uncertainties. Rather, at this point, it would appear the effort could better be spent in assuring that all significant risks are identified and in developing or improving estimates of the identified parameters.

It should be noted that the above comments should not be construed as downplaying the importance of uncertainty to the entire risk assessment process. A risk assessment is meaningless to a decision maker without some sense of the uncertainties involved in the analysis. In essence a risk assessment must be viewed as a dynamic process in which the analysis and its credibility are improved with time as parametric uncertainties are identified and reduced through an ongoing research process.

3. The techniques that are utilized in the risk analysis appear to have been chosen primarily because of availability and apparent general appropriateness to environmental risk assessment. The selection criteria regarding the ability of the technique to address the issues and complexity inherent in the

problem do not appear to have been adequately considered. Hence, procedures other than AHM, which explicitly address value judgements and professional judgements seem to be excluded (e.g. decision analysis, and social impact analysis etc.).

4. With regard to AHM, specific technical comments with respect to this process, as stated in the ORNL reports are simply not correct. The Delphi Procedure is not a widely agreed upon procedure, nor does it necessarily lead to a consensus.

5. The radiological dose assessment was evidently used as the basis for estimating the steady-state transfer from soils to plants to animals. The original model is quite sophisticated as to consumption patterns, living patterns, specific food chains, climatic and precipitation variables, etc.--perhaps too sophisticated for application to chemical contaminants. A useful contribution has been made by ORNL in dividing the U.S. into regional "cells" for computational purposes, there are, however, some potentially serious problems in this approach in that important intra-regional differences may be ignored.

6. There was concern expressed about the lack of consideration of metabolism and metabolite formations. It was apparently assumed that inorganic molecules tracked the soil to plant transfer of organic compounds such as the PAH category. It is felt that the approach is highly provisional and is valid only to the extent that metabolic processes do not greatly change the parent compound or the relative potency of its metabolites. There has been enough work done on the unified theory of molecular carcinogenics to bring this whole concept into

question. Any particular transfer coefficient could come under severe scientific criticism because it ignores metabolism, soil microbial, geochemical and other (e.g., photo-oxidant) transformations of the organic compounds. This approach may, in some cases grossly over-estimate, or under-estimate, actual concentrations in foodstuff for a given contamination event. Despite this concern, it was felt that the effort is worthwhile in that the approach has utility in giving a benchmark against which to evaluate actual data as they become available. In the absence of any real data, this may serve as a useful scaling function for some of the RAU's.

7. A common serious concern voiced by the Review Group as a whole was that involving the lack of testing or "validation" of the methods and models used. The Group felt that it was essential that experimental/field data be collected which will permit one to test the various methodologies available. The Group fully realized that acquiring such data will require considerable expenditures of cost and time, but is essential if environmental risk assessment is to become something more than just an interesting academic exercise. Typical of the Group comments provided was the following:

> "I would place highest priority on testing the methods that are being developed. We were shown comparisons of the results using the different analysis methods but never was a method applied to a "real" or simulated (microcosm) system and the results of such an application

compared to observation. Without this step, scientific credibility is impossible."

Health Risk Assessment

The health effects assessment of Synfuels under study of Brookhaven National laboratory (BNL) is in its early stages. As such, it is difficult to comment extensively on the preliminary work in this area. No report was presented on the health exposure portion of this study. The health effect assessment was limited to carcinogenesis due to the RAU encompassing polycyclic aromatic hydrocarbons. Effects are estimated from exposures via air, surface water, terrestrial and aquatic food chains utilizing information supplied by ORNL. Dose-response functions for cancer are extrapolated from animal data. Cancer risk is calculated using the 1-hit, multi-hit, multi-stage, Probit, Logit, and Weibull models.

Specific Peer Group comments are:

1. As presented to date, the BNL work appears to be well thought out and sensibly organized. Given the present state of the art for assessing risks from low doses of potential carcinogens, they have defined an approach which delineates the uncertainty between cancer mechanisms (and models) and data limitations.

2. Considerable concern was expressed with regard to the credibility of dose-response relationships at low-dose levels (those that one might expect to find as a result of synfuel

production). The extrapolation from high dose experimental data to low dose effects may constitute the major uncertainty in the health assessment for the foreseeable future.

3. Some of the predictions from the flexible models, such as Probit, are highly sensitive to very small changes in the data. One additional cancer can increase the estimate of risk, in some cases, by several orders of magnitude. Also, the Probit, Multi-hit, and Weibull models can produce estimates which make chemicals appear to be ultra-potent.

4. Data sets which contain only two dose levels are apparently omitted at present. These data sets should be included as their omission can cause bias.

5. The linear approximation used to estimate risk can cause large errors when the background level of a pollutant is small or non-existent.

6. The health effects assessment should work towards incorporating effects other than cancer (e.g., reproduction or respiratory effects) and towards making use of wider types of data. For example, consideration should be given to the use of data from short-term tests, including in vitro studies, skin painting, etc.

The Risk Analysis Unit (RAU) Concept

As stated earlier, the RAU concept was developed to permit a rational grouping of the myriad of chemical compounds potentially emitted from a synfuel site. As currently used in

this program it provides common analysis categories for both the environmental and health effects assessments.

Specific Peer Review comments are:

1. The RAU concept adopted by ORNL for exposure and environmental assessment and to a lesser degree by Brookhaven for health risk analysis seems to be a workable compromise between the over-whelming problem of dealing with a large number of chemicals on a case-by-case basis and the intractable problems associated with risk assessment of complex mixtures. The approach has limitations, e.g., the toxicity of an RAU category for one industry may be quite different than that of the same category for another industry, but these difficulties seem surmountable if rigid estimates of RAU toxicity are avoided. The rationale provided for use of RAU's was straightforward and reasonable, chemical categorization must be compatible with analytic methods, and categories should be mutually exclusive and collectively exhaustive.

2. One should identify clear criteria for selecting the risk analysis units (RAU). The approach, however, should be systematic in selecting the RAU's given not only what information is available, but more significantly, what information is desired from the analysis. For example, RAU's contain compounds that have significantly different effects on health and the environment. Since they are used for risk assessment should they not be categorized on the basis of health

and environmental effects?

With regard to RAU's for the purposes of Brookhaven National Laboratory, it might be useful to redefine certain groups in terms of a parameter such as relative toxicity. Issues raised about the widely varying toxicity of separate chemicals within an RAU might justify such a changed orientation. If the toxicity is known to vary widely, certainly the chemicals can be separately categorized.

3. RAU's for trace elements need to be "compound specific." Trace elements may have several oxidation states and be present as the oxide, chloride, etc. These different compounds will have different health and ecological effects and should be categorized as such.

4. RAU's for total stream matrices and possibly fractionated stream matrices (e.g., extractable organics--neutral/acid/base) can be defined based on experimental data.

5. Selection of the RAU's was probably based on existing sampling data. These data are, for the most part, taken inside process streams and do <u>not</u> reflect what compounds will be present in a synfuel plant's stream ultimately discharged to the environment. There are little or no data on treated effluents. These water treatment data do not represent an "integrated" plant effluent since other plant waste waters (e.g., raw waste treatment, filtration backwashes, sewer water, etc.) will be routed to the waste water treatment system. The RAU list can be prioritized based on what one would expect to reach the

environment. However, fugitive emissions and worker exposure during routine maintenance should include all of the RAU's.

General Comments

The following represent Peer Review Comments applicable to the entire EPA Synfuel Integrated Risk Assessment Program:

1. No treatment of occupational risk was discussed at the review meeting. Better integration of exposure data at pilot plants and industrial hygiene experience is needed to assess the occupational risk. Uncalibrated models are not likely to be useful for this effect.
2. Transient emissions may be the most environmentally significant problem associated with synfuels plants. Source estimates need to be made and in turm "spiked" ecological experiments performed to simulate these transient conditions.
3. A close review of the approach used to calculate plant emission sources is imperative. These data will drive the effects work. Since ORNL is directing this work, ORNL personnel need to thoroughly understand how the emission data are calculated, what data sources were used, how certainties are defined, etc.

The results as applied to a real synfuels plant are questionable because representative emission source data had not been validated and therefore, not used. One of the conclusions

reached was a prioritization of RAU's needing further work. This prioritization was based on equal emission rates for all RAU's. This will bias the model results and is not representative of a real life situation. The first step in prioritizing pollutants is to determine (or estimate) their presence and concentrations in discharge streams. Various technologies produce significantly different pollutants. The uncertainties of source emissions from different technologies need to be addressed. The characteristics of these discharge streams will also be different from plants using the same technology in that the selection of gas purification and pollution control systems will significantly affect the composition and flow of plant discharge streams.

4. Overall, the program is not, as yet, accomplishing the goal of effectively providing inputs to research needs. Very little was presented that would help decide where data need to be developed. Let us illustrate this using the health effect assessment. One would think that EPA would like to know where the gaps are in characterizing the health effects of RAU's. This probably could be accomplished by estimating what are likely to be the important RAU's, what are the important constituents of each RAU and what is known of each of these. This would give some idea of where data need to be generated through additional research. Similarly, one could list the major assumptions associated with using animal data to estimate human effects and decide what experiments might be helpful in improving this process.

Similarly, in the case of the ecological risk assessment program, the outputs from the models presented would not be particularly helpful in guiding research. The AEE method outputs a number which reflects both toxicity and uncertainty. It is impossible to tell whether a high value results from a high level of toxicity or a high degree of uncertainty. Further development of this approach should be directed toward uncoupling these two aspects. It is believed to be feasible to present "best estimates" of the probability of harm and separate measures of the uncertainty in these estimates. The "best estimates" might be more useful to planners of control technology allocations whereas the uncertainty estimates might be useful in helping to guide research.

5. The RCRA risk-cost model which is also being developed by EPA has some features which might be worth considering for risk assessment for synfuels. The human health risk portion of the model considers many different types of human risks. The model develops "health risk scores" which can be applied to the components of a waste stream. These scores reflect the release rates, toxicity, persistence, and local conditions such as hydrology and population density. The scores are measures of harm to human health and can be converted, in a rough sense, to absolute estimates of numbers of cases. An approach similar to this might be considered for ecological assessment. That is, scores might be developed which are based upon a number of ecological parameters, and are felt to reflect environmental

impairment. It might even be possible to use actual data from a real episode involving specific measured amounts of ecological impairment to calibrate the scores so that they truly represent risks of ecological harm. Such an approach could permit integration of a variety of data pertinent to ecological damage potential.

6. It is believed that this program should be viewed as a five-to ten-year effort to systematize the approach to integrated risk assessment. In view of the apparent uncertainties, the idea of having meaningful risk estimates in three years is unrealistic. Risk assessment must be viewed as a dynamic process that improves as delineated uncertainties and short-comings in the analytic process are reduced.

Recommendations

1. It is essential that a credible attempt be made to provide the data needed to test the environmental models proposed to be used. Such field experiments would include structural and functional measurements of algae or periphyton, aquatic invertebrates, and/or fish communities in a synfuel receiving system. However, an artificial stream microcosm, allowed to colonize with periphytes and seeded with selected insect populations, then dosed with increments of synfuel effluent, could be utilized as a substitute for the real world.

2. In general, the initial risk analysis program will not provide a scientifically credible evaluation of possible hazards

unless the emission sources are well defined (or characterized). Also, transformation of species in the environment cannot be defined until the sources are characterized.

Additional work needed to improve the credibility of the evaluation includes the following:

a. Development of process models/experiments to characterize the emission streams.

b. Development of a program to understand the effects mechanisms of the total stream matrix (e.g., how a "representative" effluent discharged to a receiving water body affects the stream/lake/river ecology.

c. Initiate work to identify the trace inorganic compounds present in the plants discharges.

If these cannot be done, then appropriate simplifying assumptions need to be made in the risk models. It is necessary to make sure that model and data accuracy are consistent.

3. Identification of carcinogens. By limiting consideration to chemicals found to be carcinogenic in animals and man, the possibility of false negatives is significant. Attention should be given to the distinction between those cases in which negative findings of carcinogenicity have been obtained from chemicals for which no experiments have been reported. A wider set of criteria for consideration of carcinogenicity should be developed. In particular we suggest the use of bioassay data.

4. Some attempt should be made to analytically discuss the

implications of using all animal tumors as indicators, rather than only malignant tumors. How will this assumption affect human risk estimates?

5. Explicitly consider uptake and metabolism of major chemical hazards, and, if possible, base estimates on comparisons with animal data for doses to target organs. The relevancy of animal experiments should include consideration of the exposure pathway; e.g., an animal inhalation study should not be given equal weight as an ingestion study when the human pathway is ingestion.

6. Endorsement of Delphi techniques and of the analytic hierarchy method is not justified, and no sensitivity to the difficulties and pitfalls of using subjective probability elicitation is indicated. Subjective methods may be needed in some instances, and subjectivity is inescapable in risk assessment. The group needs and should seek assistance if they plan to continue in this area in a formal way.

7. Examine the feasibility and desirability of providing subclassifications of RAU's based on adverse health and/or environmental effects.

8. Examine the possibility of reducing the toxicity data variability in the environmental models by using Bergman's data base rather than the Columbia River data base. This is predicated on the fact that since the Columbia River data were collected over the period from 1965 to 1978, it is doubtful that it used the acceptable protocols throughout. The Bergman toxicity data were generated using acceptable ASTM bioassay

protocols.

9. In attempting to be constructive, this Peer review may give the false impression of being negatively critical. If this is the case, it is an entirely erroneous impression. The Group is highly supportive of the program, feels the researchers involved are quite competent in their efforts to deal with a very difficult and complex area, and recommends strongly that the research continue to be supported by EPA. The promise of risk assessment offers one of the few available viable approaches for dealing, in a thoughtful manner, with the increasingly complex problems facing a society desirous of environmental protection. Efforts such as those provided by this program, as difficult as they may be, offer the primary mechanism for ultimately realizing that promise.

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March 22, 1984

E-26-630

Dr. A. Alan Moghissi
Senior Science Advisor
U.S. Environmental Protection Agency
Energy and Air Division
401 M. Street, S.W., Mail Drop RD682
Washington, D.C. 20460

Dear Dr. Moghissi:

Enclosed is a progress report on certain activities pertaining to the EPA's Integrated Health and Environmental Risk Analysis Program for Synfuels. Certain supporting information is also attached with this report for record purposes.

If you should have any questions or comments regarding this material, please let me know.

Sincerely,

Melvin W. Carter

Melvin W. Carter
Project Director

MWC/bc
Enclosures
cc: Mr. William F. Countiss, Oakridge
~~Mr. William F. Brown, Georgia Tech~~
Mrs. Phyllis Frost, Georgia Tech
Ms. Pat Heitmuller, Georgia Tech

PROGRESS REPORT

OCTOBER - DECEMBER, 1983

PEER REVIEW OF FOOD CHAIN RESEARCH

The Food Chain Peer Review Panel met October 27-28, 1983 in Corvallis, Oregon at the EPA's Environmental Research Laboratory-Corvallis. The research programs conducted at the host Laboratory on plant uptake studies and those underway on animal uptake studies at the Medical and Health Science Division of the Oak Ridge Associated Universities in Oak Ridge, Tennessee were reviewed.

A brief summary report of the Panel's findings was given to the Project Officer at the conclusion of the review. Subsequently, a more thorough and complete report was prepared by the Panel and transmitted to the Project Officer. Copies of these reports are enclosed.

WATER MODELING FOR RISK ANALYSIS WORKSHOP ON SYNFUELS

The final Workshop report, "A Workshop on Water Modeling Needs and Available Techniques for Synfuels Risk Assessment", was completed by Anderson-Nichols/West and distributed to the Project Officer, Workshop participants, et al. A copy is enclosed for record purposes.

FOOD CHAIN MODELING FOR RISK ANALYSIS WORKSHOP FOR SYNFUELS

A draft report was received from the Environmental Risk Analysis Group of the ORNL Environmental Science Division and several technical reviewers were selected for report review.

FOSSIL BASED SYNFUELS SYMPOSIUM

Work continued on preparation for the Fossil Based Synfuels Symposium. A major part of this activity was focused around a meeting of the Scientific Program Committee in Washington, D.C. on December 20, 1983.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ENVIRONMENTAL RESEARCH LABORATORY
200 S.W. 35TH STREET
CORVALLIS, OREGON 97333

October 28, 1983

Dr. A. Alan Moghissi
Project Officer
Integrated Health and Environmental
Risk Analysis Program for Synfuels
Energy and Air Division (RD-682)
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

Dear Dr. Moghissi:

The Peer Review Panel conducted a peer review of the pertinent research being conducted in the plant and animal uptake of synfuels chemicals as related to the food chain on October 27-28, 1983, at the facilities of the EPA's Environmental Research Laboratory, Corvallis, OR. These programs, supported by the Integrated Health and Environmental Risk Analysis Program for Synfuels, are located in Oak Ridge, TN and Corvallis, OR.

Dr. G. R. Eisele, Principal Investigator for the animal studies, Dr. J. C. McFarlane, Principal Investigator for the plant studies, and selected members of their research groups presented their respective research programs and participated in relevant discussion with the members of the Peer Review Panel.

For the animal research activities the Panel is generally satisfied with the quality of the research and the interest and enthusiasm of the researchers. The Panel notes that several major recommendations, made by the comparable Peer Review Panel in May 1982, have been accepted and incorporated into the research protocols.

The intent and design of the research effort are sound and the program is producing results in a format compatible with direct application to food chain models. It is also apparent to the Panel that Dr. Tsai is making valuable contributions to the research effort as the principal chemist and the over-all research climate in which this program is located has materially improved.

Several suggestions are made to improve and strengthen this research program. These primarily relate to optimization of experimental procedures and applicability of research results. These suggestions are summarized in brief form below:

-- consider adding an additional data point at 120 hours in the acute studies

-- pre-treat the experimental animals to minimize variations due to subtle effects of treatment

-- determine milk fat/body fat ratios for predictive use

-- standardize specific activity of each compound across species

-- collect and analyse blood at time of sacrifice

-- consider increasing numbers of test animals for clearance data (specifically poultry and swine)

-- evaluate results for acute studies prior to performing chronic experiments.

For the plant research program the Panel is equally satisfied with the quality of the research program and the interest and vigor of the researchers. The experimental environmental exposure system is well designed and sophisticated. It contains parameter controls which facilitate the establishment of precise structural uptakes and has highly automated devices for measurements and control of the experimental system. These lead to rapid data presentation in various formats.

The determination of parent compounds and total metabolite analyses will be most useful. The Panel recognizes the capacity of the experimental environmental exposure system to systematically test large numbers of compounds and thus serve as a rapid screening procedure.

There is a limitation in data interpretation whereby false positives may be produced. Another concern of the Panel is the lack of clarity as to the application of experimental hydroponic results to useful risk analysis.

The Panel is also concerned with the environmental fate of parent compounds in soils as to bio-availability, persistence, degradation, concentration gradients, mobility, absorption, microbial decomposition, characteristics of the soil, etc. These are considerations not only in dealing with the real world but in translating research results into other components of the risk assessment model. The Panel also feels that known or suspected environmental behaviour of parent compounds in soil systems should be given major consideration in selection of test synfuels chemicals and that the selection process should be coordinated.

There is also a feeling of the Panel that foliar exposure of plants to synfuels chemicals is an important and primary food chain route for human exposure and should be given priority attention.

You recognize, of course, that this is a concise summary of the evaluation of the Peer Review Panel and will be followed by a more comprehensive report. This summary will hopefully be useful to you prior to receipt of the Panel's formal report.

Sincerely yours,

Food Chain Peer Review Panel
Dr. A. S. W. DeFreitas
Dr. Allan Isensee
Dr. George Lucier
Dr. Anne Spacie
Dr. Melvin W. Carter, Chairman

Georgia Institute of Technology
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November 23, 1983

Dr. A. Alan Moghissi
Project Officer
Integrated Health and Environmental
Risk Analysis Program for Synfuels
Energy and Air Division (RD-682)
U.S. Environmental Protection Agency
401 M Street, S.W
Washington, D. C. 20460

Dear Dr. Moghissi:

Reference is made to the recent Peer Review Panel Meeting held at the EPA Environmental Research Laboratory - Corvallis on October 27-28, 1983 and to our summary report which was transmitted to you by letter on October 28. The Panel reviewed the ongoing research in the plant and animal parts of the food chain transport of Synfuels which are conducted at the Corvallis Laboratory and at the Oak Ridge Associated Universities, respectively.

I'm pleased to enclose the report of the Peer Review Panel. Please let us know if there are comments or questions on the report which would be appropriate for the panel to address.

Sincerely,

Melvin W. Carter
Executive Director
Peer Review Panel

MWC/bc
Enclosures
cc: Members Peer Review Panel
Dr. A.S.W. DeFreitas
Dr. Allan Isensee
Dr. George Lucier
Dr. Anne Spacie

REPORT OF THE PEER REVIEW PANEL ON

FOOD CHAIN TRANSPORT OF SYNFUELS

PURPOSE

The purpose of this report is to summarize the results of a peer review of the U.S. Environmental Protection Agency's research effort in the area of Food Chain Transport of Synfuels. The review was conducted October 27-28, 1983 at the Environmental Research Laboratory - Corvallis in Corvallis, Oregon by a special Peer Review Panel established for this purpose. Members of the Peer Review Panel are identified in Attachment 1.

Research ongoing in animal uptake of synfuels chemicals at the Oak Ridge Associated Universities in Oak Ridge, TN and research underway at the Environmental Research Laboratory in plant uptake of synfuels chemicals in Corvallis, OR were reviewed. These programs are those supported by the Integrated Health and Environmental Risk Analysis Program for Synfuels of the U.S. Environmental Protection Agency.

PROCEDURE

Members of the Peer Review Panel were provided with various reports which relate directly to the research under review. These materials are listed in Attachment 2.

The meeting agenda is given in Attachment 3. The participants included the Principal Investigators for the animal and plant research, Dr. G. R. Eisele and Dr. J. C. McFarlane, respectively and members of their staffs. Dr. Shan-Ching Tsai, a chemist on Dr. Eisele's staff, also made a formal presentation to the Peer Review Panel and several members of the Corvallis Laboratory group made comments during the course of the review.

Dr. A. Alan Moghissi was a meeting participant as was Dr. Fred Baes of the Environmental Sciences Division of the Oak Ridge National Laboratory. Dr. Moghissi is the Project Officer of these research activities whereas Dr. Baes is involved with the modeling of the food chain for synfuels.

COMMENTARY

ANIMAL STUDIES - GENERAL COMMENTS

There was general satisfaction in the overall progress of Dr. Eisele's group on the food chain transport of synfuels in food producing animals (dairy cattle, swine and poultry). He has incorporated the important comments from the previous peer review panel (May, 1982) into the experimental protocols. For example, concentrations of parent compound and total metabolites in the various treatment groups are now quantified. The consensus opinion of the Peer Review Panel was that further characterization and measurement of individual metabolites would not be an effective utilization of resources. Although such information would be of academic interest, it would not increase the precision of risk analysis enough to warrant the large expenditure of resources required to obtain complete metabolic profiles for each chemical tested. However, the Panel did feel that in limited cases, quantification of metabolites that are known to be intimately involved in the mechanism of action would produce useful information in the risk analysis process provided that appropriate standards are available.

The Peer Review Panel felt that Dr. Eisele is well qualified to conduct the studies of food chain transport of synfuels in food producing animals as he has been conducting similar studies for a number of years and possesses a clear understanding of the problems involved in generating valid uptake and retention data for chemicals in large animals. An essential component in these studies is collaboration with a skilled chemist and the Panel noted that Dr. Tsai possesses the expertise required to identify and quantify the chemicals indicated in the RAU list. The Peer Review Panel agreed that the experimental protocols are providing appropriate information needed to produce valid risk analysis models.

Several points were raised by Panel members regarding optimization of the protocols that would increase the utility of the data without increasing costs. These are as follows:

ANIMAL STUDIES - ITEMS IDENTIFIED FOR CONSIDERATION

Because the cost of animal experimentation is high, it is important to optimize the experimental design to generate as much useful information per test as possible. A good estimate of the rate of clearance of the chemical is especially important. Therefore, it would be beneficial to include one additional sampling time for the clearance phase of the acute exposures - at least for poultry and swine. A possible sampling sequence would be 1, 3, and 5 days after exposure. Although this would require the use of additional animals, it would improve the estimate of clearance rate constants considerably. The clearance rate constant may then be used to optimize the design of the 30-day chronic test, since time-to-steady-state is a direct function of clearance rate constant. If clearance is slow, then it takes a relatively long time to reach steady-state and many of the samples taken during the uptake phase of the 30-day chronic can be eliminated. If clearance is rapid, then steady-state may be established soon after the beginning of the chronic exposure. Effort saved by reducing the number of samples during uptake should be switched to more samples during steady-state and clearance phases.

It is recommended that animals in both the acute and chronic tests be pre-dosed with unlabeled chemical for one week minimum prior to administration of the labeled material. That practice should eliminate irreproducibility caused by enzyme induction or other subtle effects.

For the same reason, it would be helpful to standardize the dose of test chemicals given to each of the three species on a gram/kg body weight basis.

The tissues that have been selected for analysis are quite appropriate. An examination of the existing information on residue levels in milk fat vs. body fat of cows should show a reasonable correlation. If so, such a correlation could be used to estimate changes in body fat residues during both uptake and clearance. It is recommended that blood be collected and analyzed at the time of sacrifice and at any other times that are reasonable, so that correlations between the important blood compartment and other tissues can be made, again for predictive purposes.

Perhaps an efficient alternative approach to the present strategy of testing one chemical thoroughly in all three species is to spend proportionately more effort testing a wide variety of chemicals in one of the species (poultry or rat). Better correlations between residue levels in fat and edible tissues could be made on that species. Only the chemicals with high bioaccumulation factors would then be retested in the expensive large animals such as the cow. A greater reliance on species to species correlations might be profitable in the long run.

PLANT STUDIES - GENERAL COMMENTS

The Panel was favorably impressed by the plant uptake portion of the study and it felt that the overall design, particularly the whole plant uptake test, is very sophisticated and well designed. The Panel was particularly impressed with the degree to which the experimental parameters (temperature, air movement, CO_2, nutrient solution circulation, etc.) are controlled and monitored. The initial results on uptake confirm the feasibility of the approach and suggest that there is a relationship between uptake rate and transpiration rate. It is felt that the quantitation of this relationship and the demonstration of its general applicability to a variety of plant species and different zenobiotic chemicals would be a very important basic contribution to the problem of applying structure-activity data to food chain modeling.

The system using whole plants has a capacity to rapidly produce a large data base , but it was not obvious to the Peer Review Panel how the results would be used with confidence in food chain modeling without incorporating soil-water-zenobiotic interactions. Obviously, results from the system using root tips to measure uptake will have to be considered suspect for use in the food chain model until correlated and "validated" against whole plant data. In this context, it is also important to stress the need to establish retention index values for parent compounds.

PLANT STUDIES - ITEMS IDENTIFIED FOR CONSIDERATION

The Panel was concerned that the hazard assessment was not addressing a very important part of the food chain transport, namely foliar exposure or contamination. It felt that direct exposure to plants of aerially transported chemicals will, in the initial development of the synfuels industry, be very important. Since aerial transport is apparently not being addressed at the present time, the Peer Review Panel feels that the plant work (i.e. plant uptake via hydroponics vs. foliar exposure) be reevaluated by the Project Officer.

The Panel felt that only part of the goal, to determine the extent of chemical uptake by plants, will be achieved by the hydroponic experiments. It feels that the ability to actually measure uptake (from the root to plant tops) is very well designed. The investigators have an excellent design and can control all of the important parameters. However, the investigators are making the assumption that the chemical will be biologically available to the plant root. The Panel feels that bioavailability and persistence of the chemical in soil must be considered in order for the plant uptake data to be useful. Obviously, if a chemical will never reach the root zone in an amount or form that can be taken up by the plant, then the uptake data will be of little value to the concept of food chain transfer. The environmental fate of a chemical in soil needs to be considered in order to determine if a chemical will be available for plant uptake. For example, some of the chemicals being studied degrade so rapidly in soil that their presence in significant levels in real world environmental situations seems unlikely. All of the many factors that influence environmental fate, such as degradation rate, adsorption, microbial population, leaching, soil properties, etc. must be considered.

The hydroponic experiments are very well designed and few additional considerations are needed. However, the Panel feels the investigators should evaluate the clearance rates of the various chemicals from the plant tissue. Analysis of the plant for parent compound and metabolites with time will indicate if a chemical is accumulating or if it is being lost or degraded.

Unless there are sound reasons for doing otherwise, the selection of chemicals for plant uptake work should be the same as that used in the animal studies. Also, published regressions are available relating soil binding of chemicals to their water solubility or partition coefficient. These should be considered to estimate the availability of the test chemicals to the plants.

ATTACHMENT 1

PEER REVIEW PANEL MEMBERS
FOOD CHAIN RESEARCH ON SYNFUELS CHEMICALS

Dr. A.S.W. DeFreitas
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ATTACHMENT 2

LIST OF REFERENCE MATERIALS

1. "Food Chain Transport of Synfuels", G.R. Eisele, Report Prepared for Peer Review Panel, 26 pages.

2. "Food - Chain Transport of Synfuels", G.R. Eisele, T. D. Traylor, O.J. Schwarz, and R. J. Chertok, Annual Report, January 17, 1983, 44 pages.

3. "Solvent Extraction and HPLC Analysis of Aniline and Its Metabolites in Animal Tissues", Shan-Ching Tsai and Gerhard R. Eisele, October, 1983, 12 pages.

4. "The Use of Roots Excised from Barley to Understand Absorption of Chemical Elements and Compounds by Plants", Carlos Wickliff, Inhouse Report, June, 1983, 17 pages.

5. "Chemical Fate in Terrestrial Plants - A Research Plan", Craig McFarlane, Hilman Ratsch, and Carlos Wickliff, 19 pages.

6. "Uptake of Bromacil by Isolated Barley Roots", Carlos Wickliff, J. C. McFarlane, and Hilman Ratsch, accepted for publication in Environmental Monitoring and Assessment, April, 1983, 19 pages.

7. "Uptake of Bromacil, Phenol, and Formaldehyde by Excised Barley Roots", Carlos Wickliff, J. C. McFarlane, and Hilman Ratsch, Inhouse Report, October, 1983, 20 pages.

8. "Isolated Root Uptake Test (IRUT) Verification Proposal", 16 pages.

ATTACHMENT 3

PEER REVIEW PANEL MEETING
FOOD CHAIN RESEARCH ON SYNFUELS CHEMICALS
CORVALLIS, OREGON

OCTOBER 27 - 28, 1983

PRELIMINARY AGENDA

THURSDAY - OCTOBER 27, 1983

8:00 A.M.	Welcome by CERL Director - Tom Murphy
8:30 A.M.	Outline of Research Program and Charge to Panel - Alan Moghissi
9:00 A.M.	Food Chain Studies with Synfuels Chemicals - Jerry Eisele
12:00 NOON	Lunch
1:30 P.M.	Food Chain Studies with Synfuels Chemicals - Craig McFarland
4:30 P.M.	Recess

FRIDAY - OCTOBER 28, 1983

8:00 A.M.	Tour Plant Research Area
9:00 A.M.	Question and Discussion Session with Researchers
12:00 NOON	Lunch
1:00 P.M.	Peer Review Panel for Evaluation and Report Preparation
4:30 P.M.	Conclusion

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TO: WORKSHOP PARTICIPANTS

FROM: Melvin W. Carter Mel

DATE: November 11, 1983

SUBJECT: "A Workshop on Water Modeling Needs and Available Techniques for Synfuels Risk Assessment".

Enclosed is a copy of the subject report which was prepared by Tony Donigian and Stuart Brown as an account of the Water Modeling for Risk Analysis Workshop for Synfuels which was held January 18-20, 1983 at the Georgia Institute of Technology. We are pleased to send it to you for your information and use.

Please send to me any comments, corrections, or suggestions you may have on the report. These will certainly be appreciated.

MWC/bc
Enclosure

A WORKSHOP ON WATER MODELING NEEDS AND AVAILABLE TECHNIQUES FOR SYNFUELS RISK ASSESSMENT

by

Anthony S. Donigian, Jr.

Stuart M. Brown

Anderson-Nichols & Co., Inc.
2666 East Bayshore Road
Palo Alto, CA 94303

November 1983

Prepared For:
Georgia Institute of Technology
Subcontract No. 1-E-26-630

Project Officer
Dr. Melvin W. Carter
Georgia Institute of Technology
Atlanta, Georgia 30332